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The Study of the Interactions between Gold, Foreign Exchange and Stock Markets in Iran

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Abstract

Financial development and attention to stock market and Stock Price Index improve and increase financial power of a country and through this, lead to increased production and economic growth in countries. For this purpose, in the present study by using vector GARCH model (vetch), relationship between three financial markets of gold, stock and foreign exchange in the timeframe of 2001 - 2014 have been studied monthly and for calculation Eviews and Excel were used. Obtained results indicated that currency market fluctuations in Iran affect ($p<0.01$) fluctuations in gold market and stock market. Also, it was indicated that fluctuations of stock market in Iran affect fluctuation of gold market ($p<0.01$).

Keywords: Gold market, currency market, stock

Introduction

One of the most important factors in achieving high economic growth is the performance of capital market as one of the important components of financial markets (Piraee and Shahsavar, 2009). Fluctuation of indices in capital markets of advanced economies normally are used as a basis for analyzing general economic conditions and in many cases caused economic growth, the extent of which is measured by growth of the capital market (Samadi, 2013). Today, financial and economic markets have close interaction with one another and there is a direct relationship between market growth with the situation in competitor markets such as gold and currency markets, physical and future trades. If a ratio can be defined for the extent of cash flow among gold, currency and capital, in these two markets this two ratios will be completely reverse and as much as one of them has more upturn, it is likely that the other market has more downturn and also possibility of having a slow growth rate in it also is higher (Taheri and Saffari, 2011).

Injection of liquidity into capital market, spurs economic growth and blow life in different Productive sectors of the economy. Advanced economies place so much emphasis on upturn in capital markets and monetary policies of central banks affect capital market. This is especially evident in the recent recession crisis in global economy and this is the reason why capital markets in these countries have the role of financing companies and projects (Karimzadeh, 2014).

Capital market in Iran still hasn't received extensive attention and hasn't been studied in economy seriously mainly due to lack of influence of the private sector in the economy at full capacity. Due to this, capital market in Iran has turned into an over reactive market that manifests Sudden and severe reactions with the smallest economic or political changes (Mani, 2007).

Capital market due to its characteristics should be crosschecked with other markets. Among these characteristics the following can be mentioned:

- Economic growth in our country is consistent with growth in capital market;
- Capital market leads to accumulation of physical and human capitals;
- Capital market is associated with financial transparency;

• Financial market leads to economic development;
• Capital market is in interaction with other markets;
• Capital market contributes to strengthen other markets;
• Capital market leads to development of activities in private sector; and
• Capital market indirectly contributes to financing and profitability of other markets.

Due to its type of activity, capital market essence is affected by economic and political indices simultaneously; however, the point that should be noted is the extent of this effect (Humpe & Macmillan, 2006).

In the present study, we have tried to study the interactions between financial markets and to this end, vetch model was used. This method is a new method. Vetch method is a method for studying the effect of markets fluctuations on them and on other markets and which has never been done in Iran so far. GARCH type models are used extensively which is due to the fact that they are easier and more successful for modeling time-dependent fluctuations (Bollerslev, 1998) and also due to the fact that they provides us with more accurate predictions of fluctuations. The first autoregressive conditional variance model was presented in 1982 by Engle and he won a noble prize in 2003 for his contributions in Modeling fluctuations. After that, Bollerslev ion 1998 introduced GARCH models with introducing generalized ARCH. GARCH models mainly depict three characteristics of financial returns.

Recent advances in the field of Financial econometrics have led to presentation of quantitative models that by using them investors' policy with regards to their expected risk and return as well as existing fluctuations in market can be explained. Today, financial analysts by using Econometric time-series models are seeking to model and explain return behavior in stock market. Two main fundamental characteristics of financial time series, that is, existence of broad sequences of data distribution and clustered fluctuations in them can be modeled by using GARCH family models. Engle (1982) for the first time presented a model on the basis of which he managed to model Conditional Heteroskedasticity Variance. Bollerslev (1986) with extending Engle's model, introduced Generalized Autoregressive conditional heteroskedasticity (GARCH). From that time, various models have been presented on the basis of initial model of Engle by various researchers which have been used extensively in the field of financial time series analysis (Imran, 2010).

In this study, vector GARCH models are presented as proper tools for analysis and prediction of financial markets' effect on each other which enables stock returns modeling to play a critical role in studies. Results obtained from this model's prediction are a fundamental factor in risk and crisis management as well as for financial policy makers.

Considering the role of financial markets in growth and development of economy in differn3et countries and Increasing expansion of these types of makers and their important role in determining commodity prices and the value of different currencies, we cannot suffice to the news and information related to that specific commodity or currency and more comprehensive data and information are needed for achieving the desired result. Therefore, we have studied the interactions between three financial markets of gold, currency and stock in Iran by using Vector GARCH. Hence, the present study seeks to answer this question, that whether there is a significant relationship between financial markets of gold, currency and stock in Iran or no? For this purpose, in the following sections, research method, findings and conclusion are presented.

Research methodology

Research variables in this study include the variables of monthly gold price, stock price and currency price in Iran. For testing research hypotheses, monthly time series data in the timeframe of October 2001 - November 2014 of our research variables, that is, Tehran Stock Exchange stock

price index was collected from Tehran Stock Exchange Organization and Central Bank of Iran and by using Multivariate GARCH Model (VECH) collected data were analyzed by using E-views version 6.

Application of traditional and usual method of econometrics in estimation of model coefficients by using time series data are based on the assumption that model's variables are steady. A time series variable is steady when the average, variance and coefficients of its autoregressive are steady over time. If the time series variables used in model estimation are unsteady, at the same time that it is likely that there is no significant relationship between the model's variables, the obtained coefficient of determination of R^2 can be so high and can lead us of make incorrect deductions regarding the extent of relationships between variable. The reason for coefficient of determination of R^2 being high is that when time series such as Y_t has a trend and the total distribution of regression, that is, $\sum(y_t - \bar{y})^2$ is calculated around the average of $\bar{y}$ which incorrectly has been assumed steady over time. This will allocate so much of weight to those observations that are distant from the average of $\bar{y}$ on both side and therefore, the total calculated distribution becomes too large.

Since, the coefficient of determination of R^2 is calculated as $R^2 = 1 - [(\sum e_i^2 / \sum (y_t - \bar{y})^2]$; where, e_i is error terms of regression, when $\sum(y_t - \bar{y})^2$ is too large, the term inside the above bracket becomes small and therefore a large R^2 is obtained. Existence of unsteady variables in the model at the same time cause usual t- and f-test to not have the necessary validity. In such as situation, critical values provided by t and f distributions are not correct critical values for performing the test. Critical values resulting from t and f distributions are such that with increasing sample volume they introduce more possibility of H0 rejection. With rejection of H0 falsely it is concluded that there is a strong and significant relationship between model's variables, while, this is not true and the resulted regression is nothing but a fake one. Since, time series of macroeconomics are generally unsteady, specially nominal variables in Inflationary Conditions have an upward trend, therefore, it is necessary to be fully aware of the problems and outcomes of using unsteady time series data and the possibility of occurrence of false regression in empirical studies. One of the usual characteristics of a false regression is having large coefficient of determination of R^2 (near 1) and small Durbin - Watson value (D.W.) (near zero) (Abbasian, 2008).

Research model and hypothesis testing

Since the estimated model is a function of macroeconomic variables, there is a tendency in most of macroeconomic time series to move in the same direction as one another. The reason for this is the existence of a trend which is common in all of them. If unsteady time series variables are used in estimation of the coefficients of a model, the outcome might turn out to be a false vector. It is because, this tendency is seen in those variables with trend, even in those cases in which there is no significant economic relation. Hence, for testing research hypotheses, research theoretical models are estimated in two parts. The first part, addresses the estimation of time series models related to each of the financial markets and the scorned part also estimate communication models between financial markets, in a way that each of these models in terms of conditional variance time series equations are estimated as following.

Conditional variance equations in estimation of the model of finical markets:

A: Conditional variance equation of fluctuations (GARCH) for stock fluctuations

GARCH1 = M(1,1) + A(1,1)*RESID1(-1)^2 + B(1,1)*GARCH1(-1)

B: Conditional variance equation of fluctuations (GARCH) for gold fluctuations

GARCH2 = M(2,2) + A(2,2)*RESID2(-1)^2 + B(2,2)*GARCH2(-1)

C: Conditional variance equation of fluctuations (GARCH) for currency fluctuations

GARCH3 = M(3,3) + A(3,3)*RESID3(-1)^2 + B(3,3)*GARCH3(-1)

Conditional covariance equations for estimation of the relationship between financial markets:

A: Conditional covariance equation for stock and gold fluctuations

COV1_2 = A(1,2)*RESID1(-1)*RESID2(-1) + B(1,2)*COV1_2(-1)

B: Conditional covariance equation for stock and exchange rate fluctuations

COV1_3 = A(1,3)*RESID1(-1)*RESID3(-1) + B(1,3)*COV1_3(-1)

C: Conditional covariance equation for gold and exchange rate fluctuations

COV2_3 = A(2,3)*RESID2(-1)*RESID3(-1) + B(2,3)*COV2_3(-1)

In the above models, estimation coefficients are:

M(i,i) : Refers to self-average coefficient of market i, and indicates to the extent to which fluctuations of market i are affected by the average of fluctuations of the same market in the past.

A(i,i) : Refers to self-fluctuation coefficient of market i, and indicates to the extent to which market i, is affected by fluctuations of market i, in the past, regardless of the information content of fluctuations of market in the past. In other words, A(i,i) shows the effect of information in market which are not controlled by market fluctuations.

B(i,i): Refer to the extent to which fluctuations of market i are affected by fluctuations of the same market in the past.

A(i,j): Refers to other market - fluctuation coefficient of market i, and shows the extent to which fluctuations of market i are affected by historical past of market i, regardless of the information available in fluctuations of market j.

B(i,j): Refer to the extent to which FLUCTUATIONS of market i are affected by fluctuations of market j in the past.

Meaningfulness of any of the above B(i,j) coefficient in above conditional covariance models leads to confirmation of research hypotheses. Therefore, conclusion regarding the confirmation or rejection of research hypotheses is made on the basis of these coefficients' interpretation.

Based on the above mentioned, first of all, in this study Eviews 6 software was used and data related to variables were entered in this software and were analyzed.

Research population and sample

Research population used in this study are financial markets of Iran. With considering this population, data were collected monthly from 2001 to 2014 for Iran for financial markets that is, currency market (USD) from Central Bank website under section of data and statistics of exchange rate [1], stock market (total index) from Tehran Stock Exchange website under prices archives[2] and gold market (coin) from Central Bank website under time series database[3].

Instruments and data analysis method

Required data for the present study were collected by using document mining method. The required data were collected from a number of databases such as time series database of Central Bank, Statistical Center of Iran and Tehran Stock Exchange Organization.

Research findings

For determining the best interruption in diagonal vector GARCH models, which study the relationships between fluctuations of the research markets, natural logarithm of likelihood ratio, Schwarz, average of likelihood function, Hannan Quinn and Akaike criteria were used. In this method, vector GARCH model in different interruptions (in this study: interruptions 1 to 4) were

[1] http://www.cbi.ir/ExRates/rates_fa.aspx

[2] http://www.irbourse.com/market/Shakhes.aspx

[3] http://tsd.cbi.ir/Display/Content.aspx

estimated and each of the above mentioned ratios in different interruptions were calculated. Each of the above mentioned criteria have similar results; however, since Schwarz and Hannan Quinn have higher accuracy, they have received more attention. The more the value of these indicators are smaller for a model, the mentioned model has higher preference in estimation of vector GARCH. According to the above mentioned, Schwarz and Hannan Quinn criteria are more appropriate for VECH (1.1) comparing to other models and this indicate that diagonal vector GARCH model is appropriate in interruption 1 for data fluctuations.

Table 1. Specifications of model

Model	Specifications of Model	
VECH(1,1)	Log likelihood	-6286.98
	Schwarz criterion	80.66
	Avg. Log likelihood	-13.34
	Hannan-Quinn criter.	80.46
	Akaike info criterion	80.31
VECH(2,2)	Log likelihood	-6354.82
	Schwarz criterion	81.72
	Avg. Log likelihood	-13.49
	Hannan-Quinn criter.	81.44
	Akaike info criterion	81.25
VECH(3,3)	Log likelihood	-6359.81
	Schwarz criterion	81.98
	Avg. Log likelihood	-13.50
	Hannan-Quinn criter.	81.36
	Akaike info criterion	81.39
VECH(4,4)	Log likelihood	-6363.30
	Schwarz criterion	82.22
	Avg. Log likelihood	-13.51
	Hannan-Quinn criter.	81.80
	Akaike info criterion	81.51

After determining the proper interruption between the fluctuations of different markets, vector GARCH model was estimated in two parts. The first part is conditional variance model of fluctuations that the estimated GARCH model provides results for each of the fluctuations regardless of its relationship with other markets. Hence, conditional variance GARCH model for markets include three models for stock, gold and currency markets. Second part also, estimates the relational model between each of the markets with other markets by using vector GARCH, which is known as conditional covariance model of fluctuations. The part also includes three conditional covariance that the first model evaluates the conditional covariance relationship between stock and gold fluctuations. The second model, evaluates the conditional covariance relationship between stock and exchange rate fluctuations and the third model evacuates the conditional covariance relationship between exchange rate and gold fluctuations. For estimating the model as it was mentioned , vector GARCH model and diagonal GARCH vetch (1,1) was used that the models are stipulated as below:

In research models, estimation coefficients are as below:

Table 2, presents a summary of findings related to estimation of each of the coefficients of vector GARCH models for i,j = 1,2,3.

Table 2. Results of vector GARCH models' fit with t errors distribution VECH (1,1)

	Transformed Variance Coefficients			
	Coefficient	Std. Error	Z-Statistic	Prob.
M(1,1)	2.62E+08	3.15E+09	0.083043	0.9338
M(2,2)	8.92E+12	4.18E+13	0.213265	0.8311
M(3,3)	47039968	5.09E+08	0.092374	0.9264
A(1,1)	0.995887	7.303053	0.136366	0.8915
A(1,2)	1.158495	5.696543	0.203368	0.8388
A(1,3)	1.122979	3.899537	0.287978	0.7734
A(2,2)	1.016943	3.243249	0.313557	0.7539
A(2,3)	1.083079	3.738594	0.289702	0.7720
A(3,3)	1.008866	4.533052	0.222558	0.8239
B(1,1)	0.973258	0.173565	5.607471	0.0000
B(1,2)	0.900447	0.487732	1.846192	0.0649
B(1,3)	0.940702	0.183143	5.136427	0.0000
B(2,2)	0.793392	0.301886	2.628120	0.0086
B(2,3)	0.848089	0.286210	2.963167	0.0030
B(3,3)	0.879911	0.522998	1.682438	0.0925

Multivariate GARCH results are presented in the table above. This model uses average simultaneous estimation and conditional variance for three financial markets in the timeframe of 2001 - 2014. The results of this model indicate to the significant effect of shocks and fluctuations among different markets.

Interpretation of self - average coefficients M(i,i) in financial markets

First for identification of diagonal VECH(p,q), SIC criteria was used. Results indicate that VECH (1,1) stipulation has the smallest SIC value. Therefore, this model is specified as VECH (1,1).

Results in table of diagonal vector GARCH model estimation and in short, for average coefficients in table 3, considering the fact that average coefficients of M(i,i) for (i=1,2,3) are not significant, it is shown that at 5% level, none of the three markets are affected by the average of their fluctuations in the past.

Table 3. Results of estimation of self-average effects of financial markets

	Coefficient	Std. Error	Z-Statistic	Prob.
M(1,1)	2.62E+08	3.15E+09	0.083043	0.9338
M(2,2)	8.92E+12	4.18E+13	0.213265	0.8311
M(3,3)	47039968	5.09E+08	0.092374	0.9264

More precisely, considering the fact that none of the autoregressive fluctuations in diagonal VECH(1,1) model are not significant, it means that none of the markets follow their own past average fluctuation. The interesting finding is that in financial markets, self average effect is not significant and these markets are not affected by their past average fluctuations. Here, while not significant, currency market and gold market have taken lowest and highest effect from their past average, respectively. Also, based on inter-average coefficients (average effect of fluctuations of one section on the average of other section) is not studied, because diagonal vector GARCH model was used and M(i,j) is not used and due to matrix being diagonal, M(i,i) is only presented.

Interpretation of self-fluctuation coefficients of A(i,i) and other market-fluctuation A(i,j) in financial markets

Considering the fact that self-fluctuation coefficients of A(i,i) are not significant for (i=1,2,3) at 6% , it is concluded that existing fluctuations in none of the markets under study are affects by historical information of market which does not contain existing information in past fluctuations. Also other market-fluctuation coefficients of A(i,j) are also not significant for (i,j=1,2,3) and indicate that financial markets' information of Iran in the past do not have an influential role on fluctuations in other markets, but the current events are significant, which indicate that in financial markets of Iran Adaptive expectations are less applicable. Table 4 presents a summary of findings related to self-fluctuation and other(market)-fluctuation coefficients in financial markets of research.

Table 4. Estimation results of self-fluctuation and other-fluctuation of financial markets

	Stock market (i=1)		Gold market (i=2)		Currency market (i=3)	
	Coef	Prob	Coef	Prob	Coef	Prob
A(i,1)	0.99	0.89				
A(i,2)	1.15	0.83	1.01	0.75		
A(i,3)	1.12	0.77	1.08	0.77	1.00	0.82

Since self-fluctuation and other-fluctuation coefficients of vector GARCH model in this study are not significant, interpretation of coefficients findings is not performance.

Interpretation of self-transfer fluctuations coefficients of B(i,i) and other-transfer fluctuations of B(i,j) in financial markets

Table 5 presents a summary of findings related to self-transfer fluctuations of B(i,j) in financial markets in this study.

Table 5. Estimation results of self-transfer and other-transfer effects of financial markets

	Stock market (i=1)		Gold market (i=2)		Currency market (i=3)	
	Coef	Prob	Coef	Prob	Coef	Prob
B(i,1)	0.97	.00				
B(i,2)	0.90	0.06	0.79	.00		
B(i,3)	0.94	.00	0.84	.00	0.87	0.09

Meaningfulness of impact coefficients of self-transfer fluctuations of B(i,i) indicate that existing fluctuations in stock markets (p-value = 0.00) and gold markets (p-value = 0.00) at first type error level of 0.05 are affected by their past fluctuations, while, it is not confirmed that currency market fluctuations (p-value = 0.09) are affected by their past fluctuations.

Also, results of significance test of other-transfer fluctuations coefficients among markets also indicate that gold market's fluctuations do not have a significant relationship with stock market's fluctuations (p-value = 0.06), while, this relationship is significant with regard to currency market's fluctuations (p-value = 0.00). Also, the relationship between stock market's fluctuations also are significant with currency market's fluctuations (p-value = 0.00) at first type error level of 0.05. In other words, existing fluctuations in currency markets are transferred to stock market and increase the fluctuations in this market. Also, transfer of this fluctuations between the two markets of gold and currency is also confirmed. While, fluctuations between stock and gold markets are not transferred to one another. For the purpose of interpreting the obtained coefficients in this section, it can be stated that:

1. 0.97 of the fluctuations of stock market are transferred to current fluctuations of this market. For each 1 unit increase in fluctuations in the past of stock market,, 0.97 unit increase is caused on this market's current fluctuations.

2. Fluctuations of gold market are not transferred to stock fluctuations.

3. 0.94 of the fluctuations of currency market are fluctuations to stock markets' fluctuations. For each 1 unit increase in fluctuations in currency market, 0.94 unit increase is caused in current fluctuations of stock market.

4. Highest level of fluctuations transfer to stock market are from stock market itself and after that it has highest influence from currency market's fluctuations.

5. 0.79 of fluctuations of gold market in the past are transferred to its current fluctuations and for each 1 unit increase in gold markets' past fluctuations, 0.79 unit is added to its current fluctuations.

6. 0.84 of fluctuations of gold market are transferred to currency fluctuations and for each 1 unit increase in fluctuations in gold market, 0.84 unit is added to fluctuations of currency market.

7. Highest level of fluctuations transfer to gold market are from currency market's fluctuations and after that the highest transfer is from the past fluctuations of this market itself.

8. 0.94 of stock market's fluctuations are transferred to currency market's fluctuations and vice versa and for each 1 unit of increase in fluctuations of stock market, 0.94 unit is added to current fluctuations of currency market. Also, 0.84 of the fluctuations of currency market are transferred to gold market's fluctuations and for each 1 unit of increase in fluctuations of currency market, 0.84 unit is added to fluctuations of gold market.

Conclusion

In recent years, a number of studies have been conducted in financial markets of Iran for predicting market fluctuations; however, the number of these studies are few and specially they have Misspecification error, in a way that in most of them, in spite of using daily data, yearly time series analysis method has been used (Shah Moradi and Zangene, 2008).

Using ARCH and GARCH models have been common in empirical works, because these model are able to estimate the variance of a series in certain time. Here, fluctuations in long term does not have much of importance for analysts, and instead the important thing is to evaluate risk and fluctuations on the basis of conditional distribution or short term. The above point indicate to Rational expectations hypothesis that Economic agents do not waste useful information in series predictions and instead of using unconditional distribution related to long-term make use of conditional short-term distribution. Hence the important of these types of model in "uncertain economy" are important (Magnus & Fosu, 2006).

Therefore, in this study Vector GARCH (VETCH) was used for studying the turbulence effect between financial markets in Iran. These predictions can be used in cases such as risk management, pricing of Financial derivatives and covering the risk resulting from them, market making, selection of financial portfolios and so many other financial activities (Mun, 2007). The importance of this topic is revealed more with looking at books and articles published in the field of returns' volatility and prediction capabilities of multiple turbulent models and reflects the importance of turbulence in investment, pricing of securities, risk management, establishment of monetary policies (Poon & Granger, 2003). In relation to economic issues as well as financial time series, multiple models have been developed for presenting turbulence and conditional variance. An initial assumption at the time of modeling turbulence is that turbulence can be divided into two predictable and unpredictable parts. Considering the fact that in financial time series, additional value of risk is a function of return turbulence and the concentration of scientific studies is on the

predictable part of return turbulence (Pagan & Schwert, 1990). According to this fact, although turbulence, is not the same as risk, however, knowing the values of turbulence due to its relationship with risk is important. When turbulence is interpreted as uncertainty, in that cases it is considered as one of the importance effective factors in investment decision and creation of asset portfolio (Davarzadeh, 2007). In fact, turbulence is the most important variable in pricing of financial derivatives. In this view, accurate and correct measurement of turbulence for pricing purpose in these financial markets is so much necessary (Poon & Granger, 2003). Apart from his, the main reason for the importance and concern for turbulence of financial markets is this belief that turbulence can affect actual economic activities reversely. This possibility in financial market turbulence can have such a broad and extensive reflection on economy, forces us to have a better understanding of turbulence trend. Therefore, with a broader understanding and measurement of turbulence, we are likely to find some solutions for reducing financial market's turbulence for policy makers (Babaee & Ahmadvand, 2008).

This study was conducted with the aim of exploring the relationships of financial markets which are a function of managers' and investors' decisions and resulted indicated that currency market fluctuations in Iran affect gold market's fluctuations and stock market's fluctuations ($p<0.01$) and also, findings indicated that fluctuations of stock market in Iran affect ($p<0.01$) fluctuations of gold market. On this basis, below practical recommendations are presented:

Considering the findings of this study with regards to transfer of turbulences of financial markets to one another, investors in these markets are recommended for making investments decisions and allocation of capital to assets in their stock portfolio, study and consider existing fluctuations in other financial markets as well, because investment in assets that appear to be low risk (low fluctuations) for creating conservatism in portfolio creation and without considering the existing turbulences in other financial markets can lead to huge loss for investors.

Considering the range of various fluctuations in different financial markets, it is recommended to perform a number of studies on multi-regime models and for example Markof-Switching Regime model for controlling and predicting fluctuations in financial markets and a more accurate explanation of the relationships between these markets.

It is recommended to pay attention to value t risk of investment in financial markets in addition to making decisions on the basis of markets' relationships, because in spite of a significant relationship between fluctuations of financial markets, value at risk of them according to their different returns in investment can be different.

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